AMRAD NEWSLETTER

Amateur Radio Research and Development Corporation

OUR AUGUST 4 MEETING will be a talk and demonstration of AMRAD's deaf communications project. Since October of last year, AMRAD has been working under a grant from the Bureau for the Education of the Handicapped, DHEW, to interface popular computers to deaf TTY standards. Computers interfaced so far have been the TRS-80, APPLE II and the PET. The Handicapped Education Exchange (HEX) will also be covered. Guests and visitors are always welcome. The meeting will be at 7:30 p.m. in the Patrick Henry Branch Library, 101 Maple Ave E, Vienna, Virginia.

WE WOULD LIKE TO THANK MIKE MARCUS of the FCC Office of Science & Technology for a fine talk at the July 7 AMRAD meeting. He talked at length about spread spectrum and possibilities for experimenting with it on the ham bands. On the subject of Special Temporary Authorities (STA's), Robert Suding WØLMD mentioned that it took much work and nine month's time for the FCC to approve the STA currently covering medium-scan TV. Marcus replied saying that the climate is better for more expeditious consideration of STA's. Marcus also mentioned some discussions with the ARRL on a possible digital ham license in the U.S. like that of Canada. All in all, those of us who attended the meeting were favorably impressed by Marcus' frank and positive attitude.

AMRAD IS GOING AHEAD WITH A SPREAD SPECTRUM PROJECT, according to a meeting held on July 6. Present at the meeting were:

Glenn Baumgartner, KAØESA
Werner Fehlauer, WB2BRB
Terry Fox, WB4JFI
Paul Rinaldo, W4RI

It was thought at that meeting that it is premature to request an STA until we decide on the basic approach, i.e., whether to use direct sequence or frequency hopping. Also, everyone thought it would be a good idea to poll various sources for information on what

had already been done by others. We are also interested in concepts for spread spectrum systems that could be built on amateur budgets. Another thing we could use at the moment is a primer (or tutorial) on spread spectrum for the AMRAD Newsletter. We have also heard from the following individuals by mail:

Mike Waters, Utica, NY
Gerald Swartzlander, W8EPI, Fremont OH
Richard Doering, WA6CFM, Argonne, IL

Anyone else interested in helping get this project off the ground is urged to call Paul Rinaldo, W4RI, 703-356-8918 days or eves.

W1AW BEGAN ASCII BULLETINS in July at 110 baud using 170-Hz frequency shift. We think that's a good step forward. What we'd really like to see is some 300-baud transmissions using 200-Hz shift, which would be more in keeping with personal computer operations on the the phone lines. The reason is that many people with personal computers already have Bell 103-compatible modems which are capable of demodulating 200-Hz shifts (2025/2225 or 1070/1270 Hz). A 170-Hz shift has been standard for Baudot RTTY on the ham bands. Many RTTY demodulators will work only marginally at speeds up to 110 baud (they being designed for 45 baud) and won't work at all at 300 baud. So the question is, should HF-ASCII try to be compatible with HF-Baudot RTTY standards or with current computer communications practices? If you have an opinion, please let us know.

THE AMRAD MESSAGE SYSTEM which was on 703-281-2125 for the past two years and operated by Bob Bruninga is being replaced by a more conventional CBBS on 703-734-1387, effective about the time you read this. The new system will use an Altair 8800, three double-density Northstar disk drives, and a PMMI modem supporting 110, 300, 450 and 600 baud callers. The new sysop will be Terry Fox, WB4JFI.

ORIGINATE/HALF-ANSWER FOR $1.98
USING THE $25 BRUNINGA MODEMS

Robert E. Bruninga
907 Ninovan Road
Vienna, Va. 22180

For a year I have been agonizing over whether or not the modem that we have installed at the repeater will do the job of automatically translating between ORIGINATE and ANSWER tones so that all users can communicate with nothing more than ORIGINATE modems. The idea seems sound, but with only 15 days to go before ASCII is really legal and knowing that the modem might not pass anything greater than about 200 baud, I begin to see the dependence on a dumb modem at a remote site as risky. With the repeater doing the translation, also, I cannot carry on a simplex transmission exchange with WB4JFI across town without using the repeater.

BACK TO THE DRAWING BOARD: So out comes the drawing board and the ubiquitous BRUNINGA modems. My previously advertized ANSWER conversion required a change in two capacitors, a tweaked resistor pair, and another tweaked resistor to set the transmitter to the answer tones. This would have required a four pole double throw switch to move back and forth between the two modes. But with a little experimentation I have come up with a way to switch the transmitter between ORIGINATE and ANSWER with only a double pole double throw switch and one tweaked capacitor and one tweaked resistor.

ORIGINATE/HALF-ANSWER: This mode has been referred to as the ORIGINATE / half-ANSWER mode since by transmitting with an answer modem and receiving with an ORIGINATE receiver, full duplex transmission is effected. (See my article in the Oct. 1978 issue for complete description) This is the ideal mode for operation on the repeater since anyone with an ORIGINATE modem can copy what is going on. If he wants to transmit, he adds the simple change described here if he has one of my modems, or he builds a simple 555 AFSK oscillator to do the Half-ANSWER transmission if he has a modem he does not want to modify.

CIRCUIT DETAILS: Looking at a schematic simply insert a tweaked capacitor in series with C7, and a tweaked resistor in series with R43. A partial schematic is shown in the attached figure to clarify the connections. To operate as usual in the ORIGINATE mode, simply short out the new capacitor and new resistor. To operate in Half ANSWER, simply open the short so that the new components are in series. To tweak

these values correctly, simply connect a mark signal to the input -(5 volts) and select the series capacitor to give exactly 2225 Hz (within about 5 is good enough). Then input a space (+12 volts) and adjust the new series resistor to 2025 Hz. The resistor will probably work out to be 220 K ohms every time. The resistor only sets the shift to 200 Hz and your real frequency was set by the right setting of the capacitor. My capacitor turned out to be a .0047 in parallel with 470 pf.

OPERATION: Now simply connect the modem output from pin 4 through a suitable resistive divider to properly drive your microphone input and bring your speaker audio out to pin 25. And that is it! You can even connect an LED to pin 28 to indicate when you are receiving carrier (or transmitting!). I am going to add a two second one-shot as well to a relay to control the PTT line of my transmitter so that all I have to do is hit a key on the keyboard and my transmitter comes up. Then so long as I keep typing, my carrier stays up. This will allow rapid turn around on the radio channel.

AVAILABILITY: These modems are available from WB4APR for $25. I think most people in the club have a few of these but I try to bring a few to each meeting just in case. See you at the next meeting, or write to the address above.
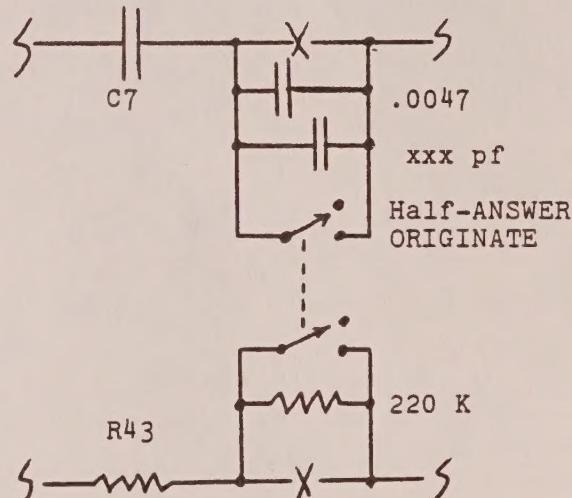

Figure 1. The Bruninga Modems can easily be converted to Half-ANSWER by adding a tweaked resistor and capacitor in series with C7 and R43.

THOUSANDS OF COMPUTERS ARE GATHERING IN WASHINGTON.
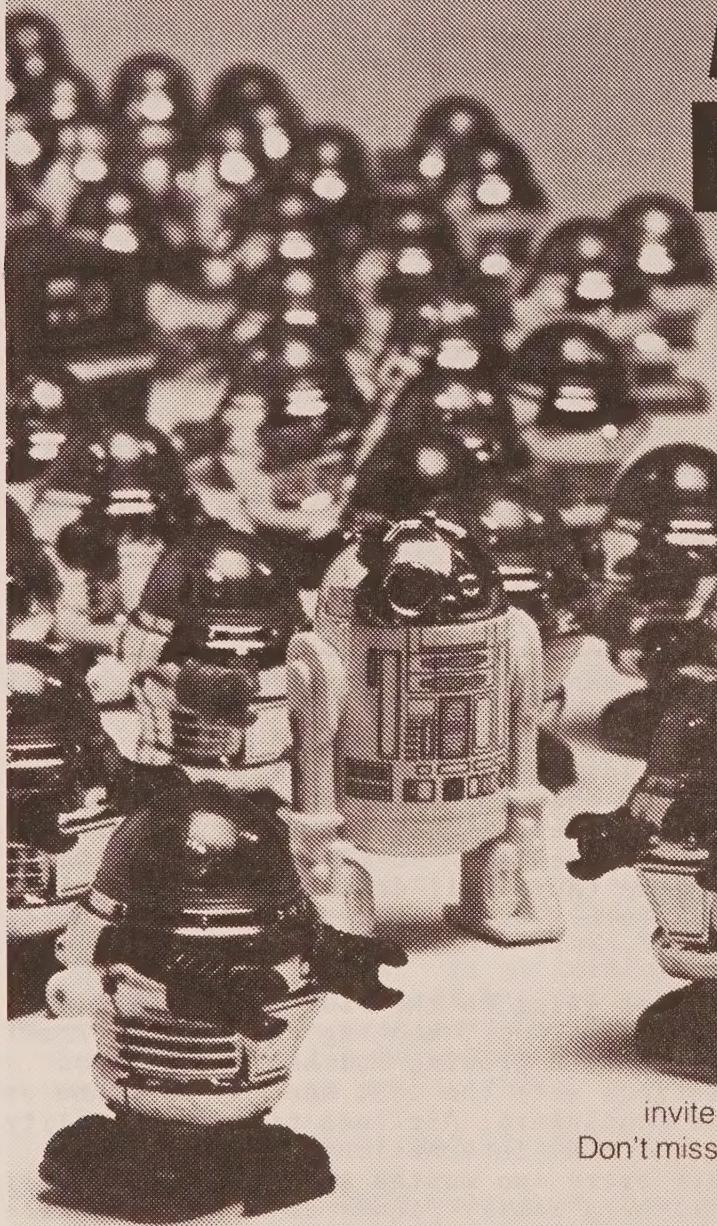
The biggest and best computer show ever to be in the Washington/Baltimore area is ready to take place. Make sure you take it in.

Over $50 million worth of software and hardware for business, government, home and personal use will be featured at the new Mid-Atlantic Computer Show in September. Computers from $150 to $250,000, mini and micro computers, data- and word-processing equipment, tele-communications, office machines, peripheral equipment and services will all be on display and for sale right on the spot.

All the major names like IBM, Xerox, Radio Shack and Apple will be there. There will be conferences on business uses of small to medium sized computers, and how to make purchasing evaluations.

Plus, robots, computerized video games, computer art and computer music will entertain and educate kids, spouses and people who don't know a program from a memory disk. It's going to be a great show for everyone. Admission for adults is only $5. The public is invited, and no pre-registration is necessary. Don't miss the coming of the computers. Show up for the show.

WASHINGTON, D.C.
D.C. ARMORY/STARPLEX, THURSDAY-SUNDAY, SEPTEMBER 18-21
11 A.M. TO 9 P.M. THURS.-SAT., 11 A.M. TO 5 P.M. SUN.

THE MID-ATLANTIC COMPUTER SHOW

AMRAD NOTES ON DEAF RTTY PHONE PATCHING

Bill Pala, WB4NFB
5829 Parakeet Drive
Burke, VA 22015
703-323-8345

The deaf RTTY idea was started in AMRAD by Bob Bruninga in the May 80 newsletter. Since then I have received several inquiries regarding the establishment of an HF deaf RTTY net.

The suggested approach is to use normal 170-Hz shift RTTY on the HF bands and convert it into the 1400-1800 Hz tones for the telephone line using a standard deaf TTY modem connected to the station loop. Deaf phone couplers are available to source 60 mA for model 19 and 28 teletypewriters. On transmit the phone coupler would act in place of the keyboard, and on receive it would send everything the loop prints out over the phone line to the deaf third party.

It has been suggested that a direct phone patch of the deaf tones be used instead of the regeneration into 170-Hz shift. This is not felt to be as desirable on HF because of the following:

1) 400-Hz shift modems are not in general use on the amateur bands. This would cause the modification of the ST-6 like units or the use of 400-Hz shift deaf modems. On HF the noise on the signal generally requires a more sophisticated demodulator.

2) The amateur station operator will still have to have a deaf modem so he can copy the QSO for third-party traffic logging.

I will be happy to serve as a point of contact for ham volunteers and deaf users.

.-.-.

COMPUTER-ORIENTED SSB NETS may be heard on the following frequencies:

Type	Day & Time (EST)	Freq. (kHz)
SWTP-6800	Sunday, 9 p.m.	14250
Digital Group	Saturday, 11 a.m.	14281
	Saturday, 5 p.m.	7190
Apple	Sunday, 9 p.m.	14329
TRS-80	Sunday, 3 p.m.	14342
	Sunday, 6 p.m.	14342

Thanks *CSAA Computer Club Newsletter*.

Dear Paul,

Up until recently I have been fighting the battle of just getting the system to function properly. Have been having a bear of a time with the software for my Diablo Hy-Type II. Still not all squared away. I have the HAM board and eventually hope to use it when I can get the ham shack and the computer closer together. They are completely across the house from each other now.

I appreciate your interest and I will be glad to contribute if I ever get something worthwhile to do so. There is not a great amount of ham interest in computers here. One fellow has a TRS-80 with N6EE's adapter for CW, etc. Another has an Apple doing about the same thing, but with emphasis on RTTY. They have an RTTY repeater on 220 here.

There is an intersting group up in L.A. called the "Southern California Amateur Radio Computer Club" and they have a repeater on Palos Verdes. It is dedicated to ASCII and computer experimentation. Unfortunately they are located below the top of the "far side" from S.D. and I can hear them a little but can't access the repeater.

I enjoy reading what AMRAD is doing and look forward to receiving it each month. As an exchange publication I have been reading it for many months. Now I'm getting it in my own right.

Incidentally, we reprinted D. Suding's AAA1200 modem article, but I don't know how much interest it has generated. I have had two or three talk to me about it. I hope someone there will design a board for it. *(Ed. Note: Bill Callaghan has taken on the job.)*

I am going to the "So. Calif. Digital Group Com. Soc." meeting in L.A. tomorrow. It has been growing and has pretty good meetings with the last one and this one at the Continental Airlines training facility at the L.A. International Airport (LAX). Meet every two months and the August meeting will be a family picnic at one of the fellow's homes on top of Palos Verdes. He has quite a spread and has invited us to bring our systems, hi!

73's,
Lon Allbright, W6SLF
San Diego, CA 92123

AN OLDE ENGLISH PRINT ELEMENT for IBM Selectric typewriters is now available from DSG, Inc., 1737 Chestnut Street, Philadelphia, PA 19103 at $29.50 each. They are designed to fit both 10 and 12 pitch IBM Selectric, Remington SR-101 and Silver Reed typewriters. DSG is the same company that repairs print elements for $7.95 each, restoring broken teeth, tops, hubs and cracks.

Protocol

David W. Borden, K8MMO
Rt 2, Box 233B
Sterling, VA 22170
703-430-7642 Voice
703-450-5284 Data

PACKET RADIO ADDRESSING METHODS

As a result of Paul Rinaldo, W4RI's letter of May 30, 1980, we received another letter from what I call the "Canadian Connection", Doug Lockhart, VE7APU. Doug informs us that Bill Moran, W4MIB has ordered the p-c board for their VADCG programmable communications interface. I have ordered one, and Terry Fox, WB4JFI has indicated that he may also. Terry and I will probably experiment with it on the repeater using Bell 202 modems at 1200 baud, just as the Vancouver group is doing now on two meters. There are still some unanswered questions to be resolved. Doug Helped a little in regards to the addressing scheme used by them. Their published material discusses an 8-byte field with 254 possible addresses per station in the network. The literature is fuzzy on this area... "254 addresses are dynamically assigned at sign on time". Doug admits that their article is superficial and does not deal with how the network modifies the end user's name and address. He is writing an article "A Proposal for an Hierarchical Naming and Addressing System for an Amateur Radio Digital Communication Network". This should answer our questions and help with the compatibility problem that could develop if we all use a different scheme than other groups. The other question high on our list is software. The software runs in two 2708 EPROM's on the interface board, but is it available now? It is working, Doug notes in the margin of his article, but can we get it? The problem is not serious as a number of us can burn 2708 EPROM's if we can agree what to put in them.

TELEPHONE CONNECTION TO PACKET NETWORKS

Paul asked Doug about telephone connection to their network. As you might expect, they intend to do this, but they have the usual security problem we had when we had the AMRAD Message System on the repeater. How do you prevent a non-amateur from abusing the system? VACDG does not intend to check for authorized users unless they detect abuse.

PACKET NETWORK BANDWIDTH CONSIDERATIONS

I have received questions concerning the actual transmission details of the Canadian amateurs. They have not fully used the 100 kHz bandwidth that they are currently allowed by their regulations. VACDG is using 1200-baud Bell 202 modems on two meters as I previously mentioned. The Ottawa group is working with VHF Engineering transmitters with single pin-diode switching which gives 9600 baud and a switching time of 1 ms. They all are experimenting with faster methods, hoping for 50 kilobaud or greater speeds eventually.

I think that we need to begin debate on transmission methods. A quick summary of the principal modulation methods (thanks to AMSAT) is as follows:

AM - On-off keyed with non-coherent detection quadrature amplitude modulation quadrature partial response

FM - FSK, non-coherent detection CP-FSK, continuous phase FSK MSK, minimum shift keying

FM - BPSK, binary phase-shift keying DE-PSK, differential encoded phase-shift keying QPSK, quaternary phase-shift keying OK-QPSK, offset keyed quaternary phase-shift keying

At present, there is no techniques which could be considered the best or prefered. Let's have some letters on the subject. Joe Kasser, G3ZCZ is proposing a 435-MHz uplink, 145-MHz downlink transponder to experiment with digital transmissions. AMRAD needs to be involved with that effort.

PCNET

Terry Fox, WB4JFI has received indication that PCNET may be defunct. In 1979 they developed "PAN", a small electronic mail system that runs on the Commodore PET with a TNW488 modem. It would be sad if that effort ceases. We all owe a lot to the PCNET project and Dave Caulkins. There appears to be some disagreement over protocol. Let us hope that it can be resolved.

MESSAGE SYSTEMS

AMRAD is just finishing up work on the first cut on the message system list.

PROTOCOL/MESSAGE SYSTEMS (continued)

It currently has 149 entries and could grow
or shrink anytime. It will be published
soon. The first impression upon looking at
the finished result is that there are a
great number of Apple message systems in
use. The second impression is that if ABBS
Forum 80 and CBBS software could each in-
clude a compatible network module, elec-
tronic mail would be a reality long before
the post office and the FCC could think
about regulating it.

.-.-.

THE CY500 STORED PROGRAM STEPPER MOTOR
CONTROLLER 5-volt, 40-pin LSI has been an-
nounced by Cybernetic Micro Systems, 445-203
S San Antonio Rd, Los Altos, CA 94022, phone
415-949-0666. The CY500 can control any
4-phase motor and can be programmed with an
ASCII keyboard. It will interface with any
computer using either parallel or serial TTL
input and provide numerous TTL inputs and
outputs for auxiliary control and inter-
facing. The TTL outputs sequence the step
per drive circuits that consist of power
transistors or transistor arrays.

.-.-.

Ham Radio Beam Antenna Heading and Distances
by Bill Gillil and WOT

from ACG-NJ News...

(HAM RADIO BEAM ANTENNA HEADING AND DISTANCES by
Bill Gillil and WOT appears courtesy of Jerry
Henshaw KB5AD and "The Bit Bucket", TEXHOMA
MICROCOMPUTER ENTHUSIASTS, November 1979)

This program calculates the beam heading and
return heading as well as the distance to any
location on earth. The required inputs are the
latitude and longitude of the amateur radio
station you are calling. This program was
written with the starting coordinates for Bill's
Wichita, Kansas station. You will need to
change these for your location. The program is
rather straight forward. This program was
written on a SWTP M6800 machine, but the BASIC
is fairly standard.

This program was written for Ham Radio use,
however, it certainly isn't limited to that use.
If you ever need to know the distance between
any two points on the earth, this program will
provide the answer. I have been using this
program for about a year and there are no known
bugs in it. Have fun using it and thank you,
Bill. This program is one of many in the M6800
User Group Library. Jerry Henshaw KB5AD.

(Editor's Notes — Lines appearing without line
numbers in the program below are continuations
of the preceding lines which have been
arbitrarily shortened to fit the column width.
An apparent typo in line 100 of our source has
been corrected. The minus sign in line 260 and
the equal sign in line 840 may be incorrect, due
to flaws in our source material.)

```
10 LINE = 80
20 PRINT "THIS PROGRAM CALCULATES BEAM HEADINGS
          AND DISTANCES FOR WOTG"
40 PRINT "COORDINATES FOR WOTG ARE:"
50 PRINT "LATITUDE = N037.62"
60 PRINT "LONGITUDE= W097.35"
65 PRINT "SPECIFICATIONS ARE IN DECIMAL DEGREES"
66 PRINT "WITH EAST LONGITUDE AND SOUTH
          LATITUDES NEGATIVE"
70 P1=3.1415926#
80 INPUT "DO YOU WANT DIFFERENT ORIGIN",A$
90 IF LEFT$(A$,1)="Y" THEN 120
100 A1=37.62*P1/180:L1=97.35*P1/180
110 GOTO 160
120 INPUT "WHAT IS THE LATITUDE OF THE NEW
           ORIGIN",A1
130 A1=A1*P1/180
140 INPUT "WHAT IS THE LONGITUDE OF THE NEW
           ORIGIN",L1
150 L1=L1*P1/180
160 INPUT "WHAT IS THE DESTINATION LATITUDE",A2
170 A2=A2*P1/180
180 INPUT "WHAT IS THE DESTINATION LONGITUDE",L2
190 L2=L2*P1/180
200 X1=SIN(A1)*SIN(A2)+
        COS(A1)*COS(A2)*COS(L2-L1)
210 GOSUB 800
220 A=69.097*X2
230 B=60!*X2
240 E=111.1*X2
250 D=X2:N=1
260 H1=SIN(A2)-SIN(A1)*COS(D*P1/180)
270 H2=SIN(D*P1/180)*COS(A1)
280 H3=H1/H2:X1=H3
290 GOSUB 800
300 IF SIN(L2-L1)=0 THEN X2=360-X2
310 IF N=2 THEN 360
320 N=2:H=X2
330 P=L1:Q=L2:R=A1:S=A2
340 A1=S:A2=R:L1=Q:L2=P:GOTO 260
360 PRINT:PRINT
370 PRINT "HEADING",H
380 PRINT "RETURN HEADING",X2
390 PRINT "STATUTE MILES",A
400 PRINT "NAUTICAL MILES",B
410 PRINT "KILOMETERS",E
420 INPUT "DO YOU REQUIRE MORE",Q$
430 IF LEFT$(Q$,1)="Y" THEN 450 ELSE END
450 IF LEFT$(A$,1)="Y" THEN 470 ELSE 100
470 L1=P:L2=Q:A1=R:A2=S:GOTO 160
800 REM ARC COS ROUTINE
810 REM X1=COS,X2=ANGLE IN DEGREES
820 Z=ATAN(SQR(1-X1*X1)/X1)
830 X2=Z*180/P1
840 IF X1=0 THEN X2=X2+180
850 RETURN
860 END
```

HAM RADIO SOFTWARE FOR THE PET is being offered by Baker Enterprises, 15 Windsor Dr, Atco, NJ 08004.

DUPE CHECK is a program to check for duplicate contacts during a contest. It searches call signs at the rate of 50 per second for quick response while operating. It has flexible operating modes for any contest format. It records data onto tape if desired, enabling restarting from rest periods without losing data. $5.

5BWAS is a program to record award records for 5-Band Worked All States or other similar awards.

Bob Baker, WB2GFE, the owner of Baker Enterprises, authors the PETpourri column in *Kilobaud Microcomputing* and the Contest Calendar for *73 Magazine*. He has 3 PET systems covering all models from the 2001-8k to the new 8032 and can test any device or software for any of the PET/CBM systems. Bob says that he is always willing to help anyone needing to test compatibility of programs on different models, time permitting. His phone number is (609) 767-3085.

NOISEMAKER & NOISEMAKER II are new boards for the S-100 and APPLE II respectively by Ackerman Digital Systems, Inc., 110 N York Rd - Suite 208, Elmhurst, IL 60126, phone 312-530-8992. These boards use GI AY3-8910 integrated circuits to generate sound effects under software control.

AN ELECTRONICS PRODUCTS CATALOG containing microcomputer interference control products is now available from Electronic Specialists, Inc., 171 S. Main St, Natick, MA 01760, phone 617-655-1532. Their line includes isolators, regulator/filter/suppressors, power line interrupters, filters, protective devices, and programmable constant-current sources. Descriptive sections are included which outline particular problems and suggested solutions.

CALL FOR ARTICLES - The *AMRAD Newsletter* needs technical articles on subjects of interest to radio and computer amateurs, particularly those that combine the two. Right now, we need articles on:

- Spread Spectrum (tutorials, concepts)

- Computer-Radio Interfaces (how to connect a TRS-80, PET, APPLE II or S-100 to amateur radio transceivers)

- Amateur Radio Software, Ham Boards

- Networking, Protocols, Data Communications

- TTY and Computers for the Deaf

Remember that we pay honorariums for technical articles at a rate of $10 per printed page ($20 maximum per author per issue). Manuscripts should be typed, double spaced.

THE MICRO CONNECTION^{tm} is an RS-232 adapter and direct connect telephone modem for the Radio Shack TRS-80. It was just announced by The MicroPeripheral Corp., PO Box 529, Mercer Island, WA 98040, telephone 206-454-3303. Unlike other modems, the MICRO CONNECTION does not use up the serial port. Its RS-232 circuitry provides an I/O port for driving any serial printer capable of 300-baud operation, even while the modem is in use. Provision has been made to permit communications over amateur radio with a feature that interfaces telephone line signals to an amateur transceiver. The $249 price includes a bus connector, power source and terminal program.

RTTY89 FOR HEATH COMPUTERS is being offered by Commsoft, 665 Maybell Ave, Palo alto, CA 94306, phone 415-493-2184. This W6LLO program includes 3-level split screen, autostart, graphics displaying status and time, CW ID, ASCII and Baudot operation. Disk and user's manual $100.

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THE AMATEUR RADIO RESEARCH AND DEVELOPMENT CORPORATION is a technically oriented club of over 250 radio and computer amateurs. It is incorporated in the Commonwealth of Virginia and is recognized by the Internal Revenue Service as a tax-exempt scientific and educational organization.

THE PURPOSES OF THE CLUB are to: develop skills and knowledge in radio and electronic technology; advocate design of experimental equipment and techniques; promote basic and applied research; organize forums and technical symposiums; collect and disseminate technical information; and, provide experimental repeaters.

MEETINGS ARE ON 1st MONDAY of each month at 7:30 p.m. at the Patrick Henry Branch Library, 101 Maple Ave E, Vienna, VA. If the 1st Monday is a holiday, an alternate date will be announced in the AMRAD NEWSLETTER. Except for the annual meeting in December, meetings are normally reserved for technical talks on computer or radio subjects.

THE WD4IWG/R REPEATER is an open repeater for data communications, voice and experimental modes. It is located at Tyson's Corner, McLean, VA and has excellent area coverage. It features a semi-private autopatch available to members. Frequencies are: 147.81 MHz input, 147.21 MHz output. The repeater trustee and head of the technical committee is Jeff Brennan, WB4WLW, 7817 Bristow Dr, Annandale, VA 22003, phone 703-354-8541.

THE AMRAD NEWSLETTER is a monthly publication which is mailed to all AMRAD members, editors of club newsletters which reciprocate and others. Technical articles, new product announcements, product evaluations, news items, calls for papers and other copy related to amateur radio and computers are welcome. Classified ads are free to members. Commercial advertisement inquiries are invited. The editor reserves the right to reject or edit any portions of the copy. All items should be mailed by the 8th of the preceeding month to Paul L. Rinaldo, W4RI, Editor, 1524 Springvale Ave, McLean, VA 22101; phone 703-356-8918. Full permission for reprinting or quoting items appearing in the AMRAD NEWSLETTER is granted provided that credit is given. Mailing is by 3rd Class bulk mail to U.S. addresses and 1st Class to Canada and Mexico. Inquire for overseas rates.

THE AMRAD MESSAGE SYSTEM is an AMI 6800 computer bulletin board system accessible by telephone on 703-281-2125. It is compatible with originate modems in the Bell 103/113 series used in many terminals and personal computers. It automatically adjusts to either 110 or 300 baud speed upon receipt of several RETURNs when you sign on. From there it is self teaching. A sister system, VIRGINIA TTY, may be used by those with deaf TTYs by calling 703-281-1214. A handicapped educational exchange (HEX) is also operated by AMRAD. For details on any of these systems, please contact Bob Bruninga, WB4APR, 907 Ninovan Rd, Vienna, VA 22180; call him on the repeater or phone 703-281-2762.

THE AMRAD LIBRARY is operated by Bob Bruninga, WB4APR. It is an extensive collection of amateur radio and computer magazines, books and catalogs. Donations to the library are tax-deductible -- check with the Librarian for details.

AMRAD IS AFFILIATED with the American Radio Relay League (ARRL), the Foundation for Amateur Radio (FAR), the Northern Virginia Radio Council (NOVARC) and The Mid Atlantic Repeater Council (T-MARC). AMRAD publishes a monthly column in the FAR magazine, Auto-Call.

TRAINING CLASSES on amateur radio and computing are run as needed by the membership. Please discuss your training requirements with any Director.

SPECIAL INTEREST GROUPS may be formed from time to time. If you are interested in joinging or forming a SIG, please contact Bill Pala, WB4NFB, 5829 Parakeet Dr, Burke, VA 22015, phone 703-323-8345.

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MCLEAN, VIRGINIA 22101

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